

# Rogue Black Hole

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Check out this Hubble image of a galaxy 8 billion light-years away. Notice anything unusual about it?

This super bright spot is not a star in the foreground blocking our view, but is actually a quasar named 3C186 that's inside the pictured galaxy.

A quasar is the extremely bright light that's emitted by hot gas surrounding a supermassive black hole.

A supermassive black hole is a type of black hole that's at least 100-thousand times more massive than our Sun and is at the center of almost every massive galaxy.

But the center of this galaxy is over here, in this green circle. This galaxy's quasar, and therefore its supermassive black hole, for some reason is more than 35,000 light-years away from the galaxy's center, and the redshift, a spectral signature of the gas in the quasar, shows that the black hole is flying away from the center at over 1,300 miles per second [over 2,000 km/s]. For reference, our Sun is moving through our galaxy at about 15 miles per second [24 km/s].

This particular black hole is over one billion times more massive than our Sun - what could have possibly moved something so enormous?

A team of astronomers led by Marco Chiaberge at the Space Telescope Science Institute think they've found the most plausible explanation.

Taking a look at the Hubble image, there is some faint material surrounding the galaxy called tidal tails, and these are produced by a gravitational tug between two or more colliding galaxies. If this galaxy is actually two galaxies that merged, then it's possible their two central supermassive black holes also merged.

As enormous objects like supermassive black holes are merging, they create ripples in the fabric of spacetime called gravitational waves. The two black holes whirl around each other, getting closer and closer, and fling out gravitational waves like water from a lawn sprinkler. If the two black holes are a bit uneven - maybe one's more massive, maybe one's rotating a little faster - then they fling out these gravitational waves more strongly along one direction.

Once the two black holes finally collide, the newly merged black hole shoots off in the opposite direction from the strongest gravitational waves. And that's what astronomers think happened to this supermassive black hole.

Based on its enormous mass and velocity, the energy needed to jettison this black hole was equivalent to something like 100 million supernovas exploding simultaneously.

So, while this may not go on your list of the top prettiest Hubble images, just think - you're looking at the light emitted 8 billion years ago from gas orbiting a 1-billion-solar mass black hole that is flying through its galaxy because it was shot off like a rocket from the gravitational waves produced by the merging of two supermassive black holes - and if that's not cool, I don't know what is.

**End**

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